

Congressional Notification Profile

DE-PS26-02NT41369

UNIVERSITY COAL RESEARCH PROGRAM, INNOVATIVE CONCEPTS PROGRAM

University of Pittsburgh

Background and Technical Information:

Project Title: "A Novel Concept for Reducing Water Usage and Increasing Efficiency in Power Generation."

This project proposes to develop an intake air-cooling system that uses ice to cool the air in coal-based combined-cycle plants, thereby increasing kilowatt output, improving efficiency and reducing water usage by capturing humidity from the air. An added benefit is that the technology can make ice during off-peak periods and storing that ice until it is used during peak demand periods. Because power output would increase even though less fuel is burned as a result of improved efficiency, a plant could sell more electricity, offsetting the technology's initial costs and operating expenses.

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Congressional District: 14 District

County: Allegheny

Financial Information:

Length of Contract (months): 12

Government Share: \$50,000

Total value of contract: \$50,000

DOE Funding Breakdown:

Funds: FY 2002 \$50,000

PUBLIC ABSTRACT

Project Title: *A Novel Concept for Reducing Water Usage and Increasing Efficiency in Power Generation*

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A unique gas turbine intake air cooling technology, using ice to cool the air, can be applied to combined cycle power plants in order to increase overall efficiency, improve heat rate, and have the additional benefit of recovery acre feet of pure water as moisture condenses out of the intake air as it is cooled before entering the turbine.

The exact increase in power available and water recovered from a particular gas turbine as a result of inlet air-cooling depends upon the machine type and plant location as well as ambient temperature and humidity. However, turbine design curves can be used to make an estimate of this benefit for gas turbine generators. It is anticipated that the improvement is greatest in hot, dry weather. The addition of an inlet cooler is economically viable when the value of the increased output exceeds the initial and operating costs, and appropriate climatic conditions permit effective utilization of the equipment.

Several type of intake air cooling have been used on natural gas fired turbines, however, the use of a chilling system tied to ice thermal storage offers the benefit of making ice during off-peak periods and then using that ice to cool intake air during peak loads thereby keeping the Kw output available for sale during peak demand period.

In the process of cooling, the air passes through the dew point and water condensation occurs. This water is very pure and has both in-plant and out-of-plant usage potential. These include:

- NO_x reduction (introducing water into downstream stages of the turbine)
- Boiler feed water makeup
- Cooling tower water makeup
- Mineral-free water for process or power applications
- A clean water source for commercial and domestic uses

If the proposed gas turbine intake air cooling technology is successfully developed for commercial applications, a large reduction in net water usage and a significant increase in total power output (through higher Kw output during peak periods) and lower fuel costs (through higher efficiency) can be achieved for power generation in this country. This would meet one of the key challenges of DOE's Vision 21 Program.